Design, Construction, and Maintenance of Concrete Pavements at Hartsfield-Jackson Atlanta Airport

ACPA Concrete Airport Pavement Workshop
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World’s Busiest Airport

- 930,310 Aircraft Operations in 2012
- 95.49 Million Passengers in 2012
- 46 Million Square Feet of Airside Pavement
  - 5 Parallel Runways
  - 92 Taxiways
  - 14 Ramps/Aprons
Airfield Pavements in 2015

H-JAIA Pavement Age Over Design (2015)

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Area (Sq.Ft.)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10</td>
<td>9,010,477</td>
<td>19</td>
</tr>
<tr>
<td>11 - 20</td>
<td>7,076,546</td>
<td>15</td>
</tr>
<tr>
<td>21 - 30</td>
<td>5,460,769</td>
<td>12</td>
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<tr>
<td>&gt; 30</td>
<td>25,432,568</td>
<td>54</td>
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Changes in Slab Dimension

- 1960s and 1970s → 25’ x 75’ reinforced
  - Used temperature steel and dowel baskets
  - Slabs eventually cracked at third points (25’)
- In the 1980s, change to 25’ x 50’ reinforced
  - Because of its tendency to “square up”
  - Mid-slab cracking was observed
- In 1990s, pavement around Concourse E was constructed at 25’ x 25’ non-reinforced
  - Minimal to no cracking
  - Led to permanent change for all taxiways/runways
Changes in Pavement Thickness

<table>
<thead>
<tr>
<th>RW 8L/26R</th>
<th>RW 9R/27L</th>
<th>RW 8R/26L</th>
<th>10/28</th>
<th>Typical Taxiway</th>
<th>Typical Apron</th>
</tr>
</thead>
<tbody>
<tr>
<td>RW 9L/27R (1999)</td>
<td>16&quot; Concrete</td>
<td>18&quot; Concrete</td>
<td>20&quot; Concrete</td>
<td>20&quot; Concrete</td>
<td>20&quot; Concrete</td>
</tr>
<tr>
<td>6&quot; CTB</td>
<td>Asphalt Cement</td>
<td>Existing CTB</td>
<td>Asphalt Cement</td>
<td>Asphalt Cement</td>
<td>Asphalt Cement</td>
</tr>
<tr>
<td>6&quot; Soil Cement</td>
<td>6&quot; Soil Cement</td>
<td>6&quot; Soil Cement</td>
<td>3&quot; Soil Cement</td>
<td>5&quot; Soil Cement</td>
<td>6&quot; Soil Cement</td>
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</table>
Innovation in Joint Design

- **1960s and early 1970s**
  - Taxiways were generally 100’ wide – four 25’ slabs

- **1970s – Change in FAA design criteria**
  - Taxiway widths were reduced to 75’

- **Longitudinal joints for 4 and 3 slab configuration**
  - Keyways with deformed steel tie bars

- **Change contributed to failures in keyways**
  - Changes in widths moved main gear loading
    - Caused increased stress due to frequent heavy loads
    - Led to premature failures of longitudinal joints
  - Malformed keyways
    - Contributed to some failures along with high stress
Innovation in Joint Design

- Main gear placement as a result of change in pavement widths

Caused premature failure of joints
Joint Design

- In late 1980s, geometry of joint and slab layout on 75’ wide taxiways changed
  - Transitioned from 3- to 4-slab width
  - Changed moved main gear to middle of slab
- Improvement in placement of aircraft gear load
  - Reduced stress and longitudinal joint cracking
Joint Design

- Changes in 75’ wide taxiways
Innovation in Joint Design

- Repairs

- Result of premature keyway failures
  - Keyways changed to butt-type joints
  - Slabs dowelled on all four sides
    - Longitudinal and transverse
Setting the Standard for Repairs
Example of Slab & Joint Layout Today
Standard for Underdrains at ATL

- ATL uses underdrains under all its pavements
  - Insurance policy for soil that does not drain well
- Required in fill and cut sections
- Contributes to long life and performance
Coping with ASR

- Alkali-Silica Reactivity (ASR) was first observed at ATL in 1984 in RW 8R and 9L, then RW 9R in 1990
- Implemented changes to mitigate ASR
  - Low-alkali cement
  - Testing of aggregates
  - Lithium
  - Class F Fly Ash
Quality Testing

- Crucial for long term performance and operational life of pavement
- Allows for thorough evaluation of design, construction, and maintenance requirements
  - Provides for better quality control
  - Confirms that the pavement is constructed as designed
  - Establishes valuable baseline for comparison as pavement ages
- Provides a solid reference to future design and performance evaluations
Ongoing Evaluations

- Formal evaluations started in 1984
  - Repeated every 3 years
- Two departure runways have served almost double their original design lives as a result of these evaluations
  - Runway 8R replaced in 2006 after 37 years of age
  - Runway 9L still operating at 39 years of age
Questions